DOCUMENT RESUME

ED 159 006 SE 024 750

TITLE	Termite Pest Control - Industrial. Manual 96.
INSTITUTION	Missouri Univ., Columbia. Agricultural Experiment Station.; Missouri Univ., Columbia. Extension Div.
PUB DATE	[77]
NOTE	18p.; For related documents, see SE 024 748-751 and SE 024 665-671; Colored photographs will not reproduce well
EDRS PRICE	MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS	*Certification; *Entomology; *Instructional Materials; *Pesticides; *Post Secondary Education; Safety; *Units of Study
IDENTIFIERS	*Missouri; Termites

ABSTRACT

This training manual provides information needed to meet the minimum EPA standards for certification as a commercial applicator of pesticides in the termite pest control category. The text discusses general pests, especially ants, and wood-destroying organisms such as termites, beetles, and fungi. (CS)

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TERMITE PEST CONTROL-INDUSTRIAL

manual 96

This manual was developed in cooperation with The Missouri Department of Agriculture and the Coop Extension Service, University of Missouri.

Assembled by Members of Extension Pesticide Training Team

SE 024 750

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INTRODUCTION

This training manual is intended to provide information needed to meet the minimum standards of the Environmental Protection Agency. It is also intended to aid you in your preparation to take an examination for pesticide certification given by the Missouri Department of Agriculture based on this manual. This training manual will not provide all the information needed for effective structural pest control but it does provide information on termites and some other structural and structural related pests. Additional information in the form of publications and short courses can be obtained from the University Extension Centers.

This material was adapted to Missouri conditions from an interim copy of a manual developed by Gary W. Bennett, in cooperation with an editorial committee, under an EPA grant.

PEST CONTROL AND PESTICIDES

Proper identification and a knowledge of pest development and behavior are the keys to effective pest control. This usually involves the use of pesticides, but more and more pest control specialists are turning to sanitation as a control device. Removal of food, water and habitat (place in which to live) are very important considerations for effective pest control. When integrated with appropriate chemical control measures, more lasting control is possible. Control also includes the use of traps, screens and other mechanical devices to catch pests or prevent them from entering.

After the pest control specialist has inspected and identified the pest problem, he must determine his course of action. If a pesticide is needed, he should select one that has label clearance for the intended use and one that is safe and appropriate for the job to be done. He must then decide how the pesticide is to be used:

- for a space spray, he might use an insecticide in oil
- for long residual activity in a dry situation, a dust
- for a surface application of a residual where appearance is not too important, a wettable powder
- for use around open flames and heat, an emulsion
- for spraying on or around plants, wettable powder or selected emulsion
- for use on or around linoleum, rubber, asphalt floor tiles, and some synthetic fibers, a water-base insecticide

Although the various formulations can be used on a wide variety of jobs in many different types of equipment, each has its own particular characteristics which help determine which is the best to use in a given situation. (See pesticides and application equipment sections of the core manual for more detailed information.)

The Environmental Protection Agency, published in the Federal Register of September 5, 1975, Pesticide Enforcement Policy Statement No. 2 (PEPS), which authorized the use of registered pesticides for the control of unnamed target pests in structural pest control. There are a number of requirements that must be complied with. Also, restrictions have been placed on the site of application and the degree of competency of the applicator.

USING PESTICIDES SAFELY

The pest control specialist must not allow pesticides to be released into the soil, air, or water except when he intends to do so as a safe and approved part of his work. Pesticides put in the wrong place, or on the wrong plant, or where the wrong animal can contact or consume them are pollutants and can cause serious harm.

The specialist also has to be particularly aware of

sensitive areas such as food handling establishments and areas where young, elderly, or ill persons are located. Carefully consider pets and their eating places. Pesticides used in or around such areas should be the safest ones available that are effective. Apply them in such a way that avoids contamination. (See using pesticides safely section of the core manual for additional information.)

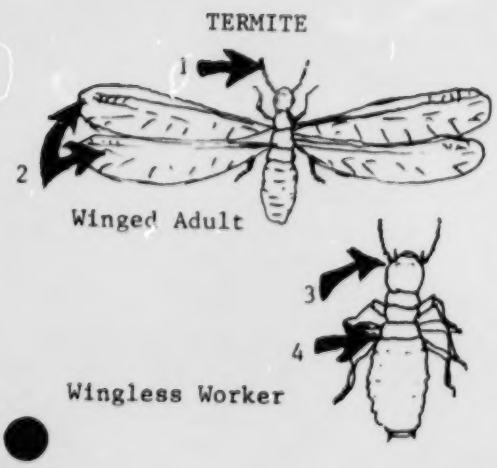
GENERAL PESTS

Ants

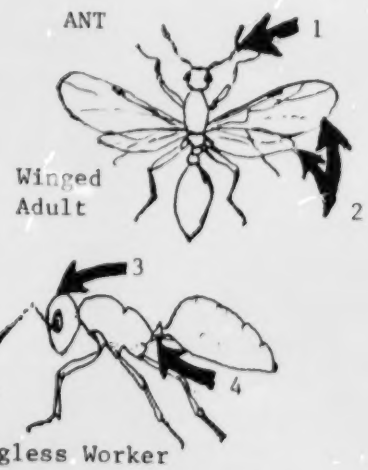
Ants can be a problem in and around the home and other structures. Most species build their nests in soil. Those that invade buildings usually nest near foundation walls or under concrete slabs. One species, the carpenter ant, builds its nest in hollow trees, stumps, and sometimes in the timbers of buildings.

- ants have a narrow "waist" like a wasp; termites a straighter body and no waist
- ants have two pairs of wings of unequal length; termites have two pairs of wings of equal length
- ants have elbowed antennae while termite antennae are straight

FOUR WAYS TO TELL TERMITES FROM ANTS



COMPARE THESE FEATURES:	
1 ANTENNAE NOT ELBOWED	1 ANTENNAE ELBOWED
2 TWO PAIR WINGS OF EQUAL LENGTH	2 TWO PAIR WINGS OF UNEQUAL LENGTH
3 EYES ABSENT	3 EYES PRESENT
4 WAIST THICK	4 WAIST THIN

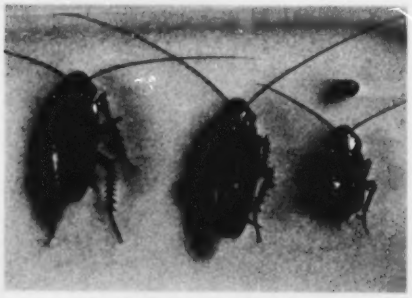


Picture Sheet No. 2

COMMON HOUSEHOLD PESTS

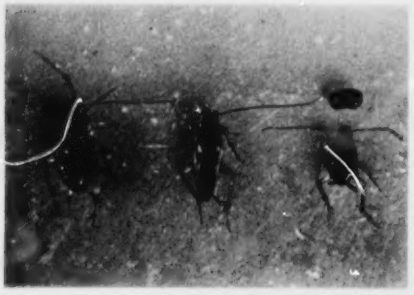
For safe and effective use of insecticides, always identify the problem correctly.

1. Oriental cockroach

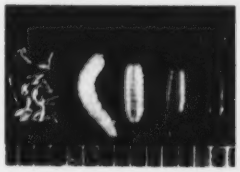


2. American cockroach

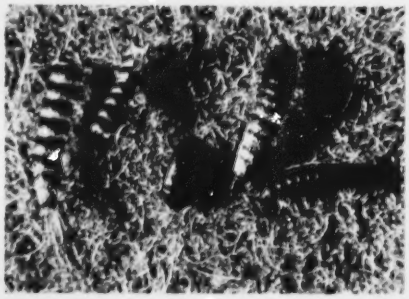
3. German cockroach



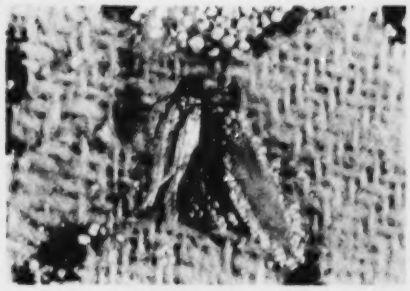
4. Brown-banded cockroach



5. House fly



6. Black carpet beetle



7. Webbing clothes moth

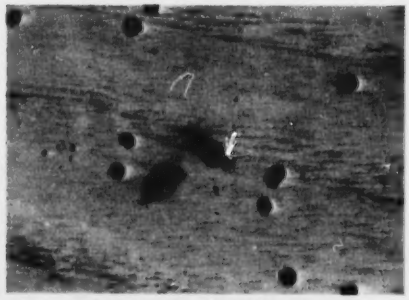
8. Silverfish

9. Flea
(greatly enlarged)

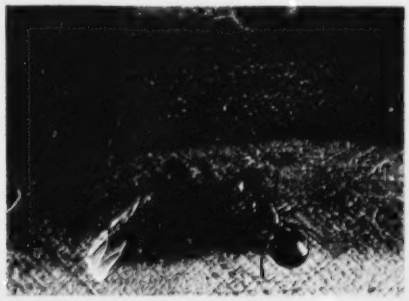
10. Brown dog tick

11. Pavement ant

12. Subterranean termite



13. Powder-post beetle



14. Carpenter ant

15. Boxelder bug

Prepared by Extension Entomologists of the North Central States in cooperation with the Federal Extension Service, U.S. Department of Agriculture

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Common Household Pests of Missouri

Leroy Peters, Department of Entomology, College of Agriculture

Fifteen household and structural insect pests, common to Missouri, are pictured on the other side of this sheet. Unless otherwise indicated the pictures are about life size.

DESCRIPTION

1. The **Oriental cockroach** is about one inch long and is dark brown or black in color. The wings of the adults do not extend past the tip of the abdomen. This insect is most commonly found in dark, damp basements, around drains or moist areas.
2. The **American cockroach** is the largest of the roaches that infest buildings in Missouri. The adult is about 1½ inches long, reddish-brown in color, and has fully developed wings. This insect is frequently found in restaurants, grocery stores, bakeries, and other food storage and preparation areas.
3. The **German cockroach** is one of the most common cockroaches found in homes. The adults are about ¾ inch long. This species is found around the kitchen, under sinks, in cupboards, around and under refrigerators and stoves, and behind baseboards.
4. The **brown-banded cockroach** is often confused with the German cockroach. However, it is slightly smaller, about ⅜ inch long, and there is a cross-band of light yellow at the base of the wings and another $^1/_{16}$ of an inch further back. The brown-banded cockroach may be found in any part of the house: under tables and chairs; in cupboards and cabinets; behind picture frames; in clocks, radios, TV sets and in other furniture.
5. Eggs, a larva, pupae and an adult of the **house fly** are pictured. This is one of the most common household pests during the warmer months of the year.
6. The **black carpet beetle** and larvae are pictured about two times normal size. This species and several related species feed on woolen clothes, carpets, furs and upholstered furniture.
7. The **webbing clothes moth** is pictured about two times life size. This species and a related species of clothes moth damage the same materials as do the carpet beetles. Adult clothes moths prefer dark areas.
8. **Silverfish** are common in houses where they cause damage by eating materials that are high in protein, sugar or starch. They eat cereal; moist wheat flour; paper on which there is glue or paste; sizing on paper, particularly wall paper; book bindings; and starch in clothing. The adults are about ½ inch long and are wingless. Silverfish live and develop in damp, cool places. They are active at night.
9. The **flea** shown here is greatly enlarged. Fleas may become a problem in any home where cats or dogs are allowed to sleep inside. The eggs of fleas are laid in bedding material and the larvae that hatch from these eggs, feed on dried skin, hair and other organic materials. The adult fleas feed on warm blooded animals, such as cats, dogs or humans.
10. Where dogs are allowed to sleep in the house, **brown dog ticks** may also become a problem. These ticks seldom feed on other animals, but may become a nuisance in houses. After ticks feed on the dog they drop off and seek concealment within the house, behind baseboards, window and door facings, pictures, light fixtures and furniture.
11. Several species of **ants** may be found in the house. Some nest outside and some nest inside the homes. Ants are usually found in the kitchen where they are attracted by sweets or grease.
12. The **subterranean termite** causes more damage to houses than any other species of insect found in Missouri. The nest of the subterranean termite is always in the soil. The principle food is cellulose obtained from wood. Their feeding and damage is concealed. Termites are exposed to light only when the winged forms swarm.
13. Several species of **powder-post beetles** may cause damage to homes. The larvae feed on the starch or cellulose in the wood and as they feed, they bore irregular tunnels through the wood. The powdery borings may be pushed out. Pin head size holes and powdery wood dust in flooring and other infested wood are signs of a powder post beetle infestation.
14. **Carpenter ants** are the only species of ants that may seriously damage the wood of the house. Unlike termites these ants do not feed upon the wood.
15. **Boxelder bugs** may become pests in the home each year in early autumn. Boxelder bugs normally feed on the leaves, flowers and seed pods of boxelder trees. In early fall they migrate to houses searching for a place to spend the winter. During warm days in the winter and early spring they come out and scatter throughout the house. They cause no damage or injury within the house.

CONTROLLING HOUSEHOLD INSECTS

For control recommendations see *MU Guide 7360, "Boxelder Bug", MU Guide 7384, "Cockroaches"*, and *MU Guide 7388, "House Fly Control in and Around the Home"*. Additional information on household pests is available from University Extension Centers, pest control operators, and pesticide dealers.

Issued in furtherance of cooperative extension work, acts of May 8 and June 30, 1914, in cooperation with the United States Department of Agriculture. C. B. Ratchford, Vice-President for Extension, Cooperative Extension Service, University of Missouri, Columbia, Mo. 65201.

SOME ANT PESTS OF HOUSES IN MISSOURI

NAME OF ANT	NEST LOCATION	ANTS IN NEST	COLOR OF ANT	SIZE WORKER	FOOD	TYPE DAMAGE	COMMENTS
Black Carpenter Ant	Trees, stumps, logs, houses	a few up to 3,000	variable but typically black	6 to 13 mm.	insects, meat, sweets, fruit, eggs	excavations in wood	needs water
Red Carpenter Ant	Trees, under rocks, houses	a few hundred to 3,000	rust colored	6 to 13 mm.	insects honeydew fruit	excavations in wood	seldom a serious pest in houses
Acrobatic Ant	Roof, siding, under porch, behind brick or rock veneer	10,000 to 25,000	head & thorax reddish brown to black, abdomen black	2.6 to 4 mm.	honeydew sweets meats	none-usually a nuisance may enlarge nest in wood	workers bite
Odorous House Ant	In house, fields, nearly any place	Few hundred to many thousand	brown to black	2.4 to 3.25 mm.	honeydew sweets, meats dairy products	none - just annoying	odor like rotton coconut
Pharaoh Ant	In buildings	Up to one million or more	yellowish to light brown, reddish	2 mm.	sweets, meat, grease general	reported to damage rubber goods & silk	workers one size very persistent
Thief Ant	Any place in house	600 to 3,000	yellowish to brown	1.3 to 1.8 mm.	seeds, meat, sweets, general	apparently none - just annoying	feed on stores in other ant nests. worker one size.
Cornfield Ant	Logs, in soil, lawns	several thousand	brown to blackish	2 to 2.5 mm.	sweets, meat, honeydew	none - just annoying	very numerous in lawns
Larger Yellow Ant	Rotton wood, along foundation walls, under walks	several thousand	yellowish	4 to 4.5 mm.	honeydew	soil from nest	move plant lice from plant to plant
Little Black Ant	Faulty wood, under rocks, in soil, masonry	25,000 to 30,000	shiny black	1.5 to 2 mm.	meats sweets general	none	can adapt to the situation. workers one size
Pavement Ant	Under rock & sidewalks, walls of houses	50,000 to 100,000	light brown to blackish	2.5 to 3 mm.	honeydew, seeds, meat grease	may cause rash on humans	workers one size
Neivamyrmex nigrescens	Along foundation walls	150,000 to 250,000	brown to reddish brown to black	2.8 to 5.8 mm.	other ants, termites, meat, beetles	none - just annoying	polymorphic petiole 2 segments

3C

The Black Carpenter Ant (Picture Sheet 2, Figure 14)

- variable in size, measuring up to 1/2 inch long
- brown to black in color
- either winged or wingless
- construct their nests in hollow trees, logs, telephone poles, posts, porch pillars and other timber used in homes
- trademark is a small pile of coarse sawdust, usually containing insect fragments, beneath their nesting place. These nests are usually found in wood with a "higher than normal" moisture condition.
- does not consume wood, but simply hollows it out to form nests
- can weaken building structures

The secret to control of ants, whether they be carpenter ants or other indoor or outdoor nesting ants, is direct treatment of the nests. In the case of carpenter ants, look for the piles of sawdust to locate the entries. Then blow dust into the nesting area. Other species may nest in soil around the foundation or out in the lawn. These can be controlled by applying an approved emulsion, wettable powder, or granular form of insecticide directly to the nest and surrounding area.

Houses built on concrete slabs often have serious ant problems. The insects nest under the slabs and enter through cracks, heating ducts and utility openings. Here, again, it is important to locate and apply insecticide to the nest.

However, if ants still get into the house, apply insecticides where the ants gain entry or hide--at foundation walls, doorways, windowsills, baseboards, behind built-in cabinets and furniture, beneath regrigera-

tors and other heavy appliances. Residual sprays in the areas usually work best, although dusts may be more appropriate in some areas.

For additional information on some ant pests of houses in Missouri see page 3A.

Honey Bees and Carpenter Bees often become serious pests in and around buildings, not only because they can sting, but also because the honey bee and carpenter bee can cause structural damage while building their nests. Honey bees may build nests in walls, chimneys, and attics. Their combs may melt and allow honey to seep through walls and ruin interior finishes. In addition, old honey combs and dead bees sometimes become infested with wax moths and dermestid beetles which may cause further annoyance. Carpenter bees may drill 1/2 inch holes into the exposed wood of buildings. The holes make a 90° turn below the surface and run with the grain of the wood for distances up to 12 inches.

Bees can be controlled using sprays, aerosols, or dust formulations of approved insecticides. These materials should be applied to the nest area. Again, it is wise to wear protective clothing when treating the nests of honey bees.

WOOD-DESTROYING ORGANISMS

Termites

Termites are social insects. They live in colonies and divide the labor between the different types of individuals (castes). Nearly all species have reproductive and soldier castes, and many have a worker caste. If a species does not have a worker caste, the nymphs handle the nest building and food gathering activities. These workers are responsible for damaging structures.

Within the reproductive caste are primary reproductives which are winged. They emerge from the colony during the warmer months of the year to disperse and form new colonies. (See ant section, page 3, for a description of these swarmers.)

Subterranean Termites (Picture Sheet 2, Figure 12)

- so named because the colony is usually located below ground, with the workers moving into wood above ground
- white, soft-bodied workers, although seldom seen, eat the soft grain of wood, leaving a thin shell outside and a splinter effect inside
- build shelter tubes from bits of soil and excrement, which they also use to close up breaks in the surface of infested wood.

Termites need wood for food and soil for moisture. Wood in contact with soil is ideal for termite development. But if this does not occur, the insects may build shelter tubes to bridge or span foundation walls and other masonry that separate wood from soil. Tubes are constructed on foundation walls or inside them if voids or cracks permit. Very rarely termite colonies are established without soil contact when a leaky roof or pipe provides moisture.

Infestations often develop in soil under slabs of concrete such as garage floors, patios, and filled porches. From there, the termites enter the building through structural wood or foundation walls adjacent to the slab. In cases of houses built partly or completely on slabs, infestation is through expansion joints, cracks, and utility openings.

The basic principle of termite control is to break the connection between wood and soil. This is done by laying down a chemical or physical barrier to eliminate all possible points of entry.

Soil on both sides of exposed foundation walls and soil surrounding supports should be soaked down to the foundation footing with the proper dilution of an approved termite control insecticide at a rate of 4 gallons per 10 linear feet per foot of depth. Application is made by trenching or a combination of trenching and rodding.

For outside basement walls (where the footing is deep) a v-shaped trench is dug against the wall. It should be at least a foot deep, or deeper, to insure penetration to the footing. After trenching a perforated hollow rod should be used to inject insecticide to the footing of the basement wall at the rate mentioned above. When treating concrete block or brick foundation walls, they should be drilled above the grade line and all voids flooded with 2 gallons of the properly diluted insecticide per 10 linear feet.

Treating slab-constructed buildings involves saturating much of the soil beneath the slab. The chemical is injected either (1) through holes drilled in the slab at 12 to 16 inch intervals next to all foundation walls, through cracks in the slab and utility openings, or (2) by drilling and rodding horizontally through the foundation wall from outside the building to reach the same key areas. Either method must be carefully executed to prevent damage to heat pipes, vapor barriers, etc. which may be located under the slab. If treating by method 1, insecticide should be applied at the rate of 4 gallons per 10 linear feet. If saturating beneath the slab by method 2, the insecticide rate is 1 gallon per 10 square feet.

Filled proches are treated one of two ways. (1) The slab can be drilled from the top as described above or the porch foundation drilled horizontally at each end next to the building, and the chemical injected by rodding. Or (2) by making openings in the foundation

wall and by digging the porch fill immediately under the slab next to the building foundation. Then treat the soil with 4 gallons of properly diluted insecticide per 10 linear feet. Also spray the fill surface, the foundation wall and undersurface of the slab.

Dry-wood Termites

- unlike subterranean termites, bore directly into wood and make their nests in the wood rather than below ground
- as they feed, they cut across the grain of wood, excavating large chambers which are connected by small tunnels
- produce distinguishing excretal pellets that are hard and have six distinct concave surfaces on the sides. These pellets are often pushed out of the colony through small holes in the wood.

Since dry-wood termites do not require any contact with the ground, treatment is quite different than for subterranean termites. It consists of covering the building with a gas-tight tarpaulin and fumigating the entire structure with a toxic gas. In minor infestations, a toxic liquid or dust may be introduced through holes drilled into the excavated chambers. Furniture and other movable objects are occasionally infested and may be treated in the same manner.

Powder-post Beetles may become serious pests in buildings. Although there are several kinds of powder-post beetles, the most commonly encountered ones fall into two groups, the Lyctid powder-post beetles (Picture Sheet 2, Figure 13) and the Anobiid powder-post beetles. The adults are small (about 1/5 inch long) and usually reddish-brown to nearly black. They all damage wood in about the same manner and require the same control measures. The surface of infested wood is perforated

with numerous small "shot holes", each about the size of a pencil lead. Any slight jarring of the wood causes a fine powder to sift from these holes. When cut or broken, the interior of infested wood may reveal masses of this finely-packed powder which is produced by the feeding of grub-like larvae. Joists, sub-flooring, hardwood flooring, sills, plates, and interior trim are the parts of buildings most frequently attacked. In addition, furniture and other products may be damaged.

Treatment involves spraying infested wood with an approved residual insecticide. All surfaces being treated must be thoroughly wetted for effective control. Chamber fumigation is often used for furniture and other movable objects.

Long-horned beetles are large (1/2 to 3 inches long), conspicuous beetles with long, thin antennae which may be longer than the body. Eggs are usually laid on unseasoned, rough-sawed timbers or logs and the larvae, called round-headed borers, feed on the wood. The larvae bore large oval-shaped holes as they move through wood. The only species that will attack timbers in a building is the old-house borer, and therefore, is the only one requiring control measures. The adult is about 3/4 inch long, greyish-brown to black with two white patches on the wing covers. Damage is usually limited to pine sapwood and can be recognized by ripples on the surface of the galleries.

If the old-house borer is to be controlled, infested timbers must be drilled and pressure-treated to force the toxicant throughout the gallery system. Only in this manner can the larvae be killed since they may be

considerable distances from the obvious points of infestation. In some cases, tarpaulin fumigation may be required.

Wood Decay Fungi occur only in wood having a moisture content greater than 20 percent. Most decay or rot fungi grow only on wood which is subject to wetting by contact with moist soil, rain, plumbing leaks, or condensation. Decay fungi, which are living plants that take their food from the wood as they grow, reduce the strength of wood, often taking it brown and crumbly or white and stringy. Discoloration and powdery growth on wood should not be confused with decay. If the moisture content of the wood is not obvious, it must be measured with a moisture meter to accurately determine the need for treatment.

The use of fungicides or insecticides alone will not stop wood decay once it has started, though it will slow its progress in some cases. The key to the complete control of wood decay is to eliminate the source of moisture, if possible, through proper drainage, breaking wood-soil contact, ventilation, the use of vapor barriers and other good construction practices. If moisture is a chronic problem, construction lumber should be commercially pressure-treated with preservative chemicals.

SUGGESTED REFERENCES

Heal, R. E. 1974. Preparing For Applicator Certification, National Pest Control Association, Inc., Washington, D.C.

Mallis, Arnold. Handbook of Pest Control, Fifth Edition, MacNair--Norland Company, New York, NY

Missouri's Structural Pest Control Certification Training Short Course: Manual Volume I, 1973; Volume II, 1974; Volume III, 1975.

National Pest Control Association. 1950-1975. Technical Releases, National Pest Control Association, Inc., Washington, D.C.

Truman, L. C. and W. L. Butts. 1967. Scientific Guide to Pest Control Operations. Harvest Publishing Company, Cleveland. 187 pages.

The following University of Missouri, Science and Technology Guides are available from local Extension offices or from Publications, 205 Whitten Hall, University of Missouri-Columbia, 65201.

7420 Termite Control in Existing Structures

7421 Preventing Termite Damage at Time of Building Construction

Issued in furtherance of cooperative extension work, acts of May 8 and June 30, 1914, in cooperation with the United States Department of Agriculture. Carl N. Scheneman, Vice President for Extension, Cooperative Extension Service, University of Missouri, Columbia, Mo. 65201. The University of Missouri is an equal employment and educational opportunity institution.